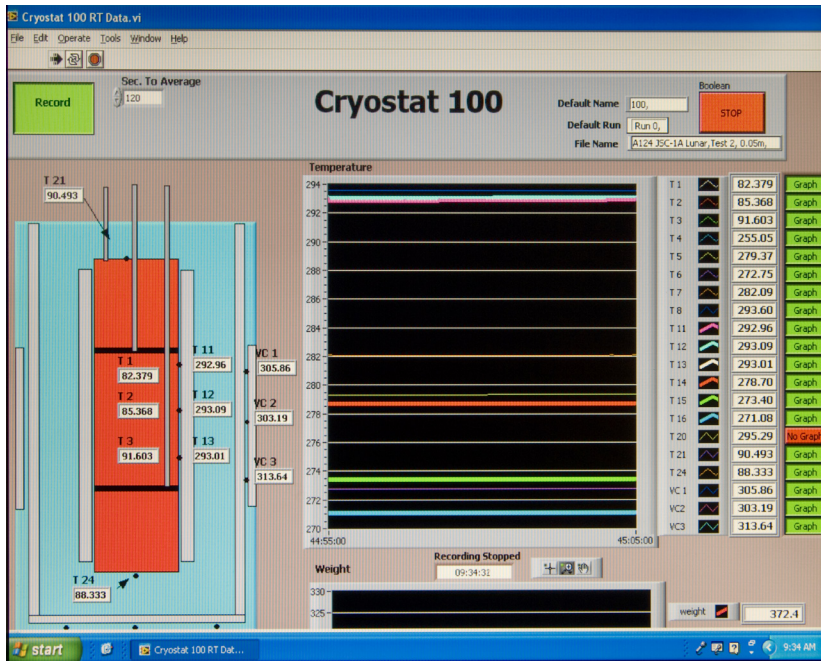




John F. Kennedy Space Center's Cryostat-100



The National Aeronautics and Space Administration (NASA) seeks partners interested in the commercial application of an insulation test cryostat. Cryostat-100 is the new world-class standard equipment for precise thermal performance measurements under actual-use cryogenic-vacuum conditions. It is an absolute heat measurement device that requires no calibration. The Cryostat-100 vacuum cylinder and cold-mass assemblies include handling and manipulation devices to make sample material changeout fast, reliable, and safe for the operator. This test apparatus is designed to determine the apparent thermal conductivity (k-value) of thermal insulation systems under actual-use cryogenic-vacuum conditions. Cryostat-100 is a liquid nitrogen boiloff calorimeter with upper and lower guard chambers and full vacuum pressure range capability. The boiloff flow from the test chamber is in direct proportion to the total heat transfer rate through the thickness of the test article. Flow rate is typically averaged over the liquid level from 88 to 92 percent to calculate the k-value.

BENEFITS

- Design is fully modular, portable, and adaptable to different fluids or environmental test conditions.
- Well suited for a wide variety of insulation materials, including bulk-fill, powders, multilayer, foams, clam-shells, layered composites, etc.
- The apparatus is easily adapted to different warm boundary temperatures up to 400 K and any cold boundary temperature above 77 K.
- The data are used to create standard reference materials for the calibration of other insulation test equipment.

APPLICATIONS

- Insulation research, design, production, or quality control testing.
- Biological specimen testing and research studies.
- Instrumentation checkout and testing.
- Structural material and composite evaluation for industrial applications, such as hydrogen fuel cells or superconducting power junctions.

TECHNOLOGY STATUS

- ☒ Patent pending
- ☐ U.S. patent
- ☐ Copyrighted
- ☒ Available to license
- ☐ Available for no-cost transfer
- ☐ Seeking industry partner for further codevelopment

Technology Details

Cryostat-100 combines the best features of previous cryostats developed by NASA, while offering new features and conveniences. This unit can readily handle the full range of cryogenic-vacuum conditions over several orders of magnitude of heat flux. Guide rings, handling tools, and other design items make insulation changeout and test measurement verification highly reliable and efficient to operate. The new apparatus requires much less ancillary equipment (it is not connected to storage tank, phase separator, subcooler, etc.) to operate properly. It is top-loading, which makes disassembly, changeout, and instrumentation hook-up much faster. The thermal stability is much better because of internal vapor plates, a single-tube system of filling and venting, bellows feed-throughs, Kevlar thread suspensions, and heavy-wall stainless-steel construction.

The cold mass of Cryostat-100 is 1m long, with a diameter of 168 mm. The test articles can therefore be of a corresponding length and diameter, with a nominal thickness of 25.4 mm. Shorter lengths are acceptable, and thicknesses may be from 0 mm to 50 mm. Tests are conducted from ambient pressure (760 torr) to high vacuum (below 1×10^{-4} torr) and at any vacuum pressure increment between these two extremes. The residual gas (and purge gas) is typically nitrogen but can be any purge gas, such as helium, argon, or carbon dioxide. Typically, eight cold vacuum pressures are performed for each test series. The warm boundary temperature is approximately 293 K, and the cold boundary temperature is approximately 78 K. The delta temperature for the cryogenic testing is therefore approximately 215 K.

A unique lift mechanism provides for changeout of the insulation test specimens. It also provides for maintenance and other operations in the most effective and time-efficient ways. The lift mechanism is also a key to the modularity of the overall system.

Partnership Opportunities

NASA has applied for a U.S. patent on the Cryostat-100 and is seeking licensees of the patent. All NASA licenses are individually negotiated with the prospective licensee, and each license contains terms concerning commercialization (practical application), license duration, royalties, and periodic reporting. NASA patent licenses may be exclusive, partially exclusive, or nonexclusive. If your company is interested in the new Cryostat-100 technology, or if you desire additional information, please reference Case Number KSC-13047 and contact:

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